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SOME PINEAPPLE PROBLEMS.

21st ARTICLE. - F R U I T I N G.

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As the success in commercial pineapple growing is measured by the financial returns, the main considerations are: (1) to produce large size fruit; (2) to control the time of fruiting; (3) to produce fruit of the desired quality. Although the per box prices for the largest sizes are not always higher or even as high as those for the medium sizes, the per plant returns are generally highest for the large fruit and, therefore, it is always safe to strive for that. As to time of fruiting, explanations are superfluous. All growers know by experience that the returns are twice or three times higher at certain times of the year than at other times. The effect of quality on prices is a disputed question. It is generally recognized that fruit from a certain field, or from some field shipped at a certain time, is of better shipping quality than fruit from another field, or that shipped at another time. As that is, among other things, due to soil moisture and other soil conditions it can be remedied to the extent these factors can be controlled. The increase in quality due to greater maturity at time of picking and the consequent higher prices obtainable is a question that most growers are not yet ready to discuss. It is important, however, and it will be included in the next article.

SIZE OF FRUIT. - The two main factors involved are: size of bloom when formed, and development of fruit from time of blooming to maturity. The first one may be more readily understood after having made a study of the plant. On cutting a non-fruiting plant longitudinally, through the stalk and growing center of leaves, it will be seen that the youngest leaves are thin and crowded very closely together on the stalk. It is evident from the size and position of the leaves that they are formed successively, one after another, from the point that is, for the time being, the apex of the stalk. On cutting another plant, on which the bloom is just forming, it will be seen that instead of producing one single leaf at the apex the center top-part of the stalk with its adhering leaves shoots out. The protruding portion becomes the flowerhead with its supporting stem and the adhering leaves become the bracts and bract-like leaves on the stem.

The diameter of the portion, here referred to as shooting out, determines the diameter of the fruit stem. That is, its subsequent growth increases the length but not the diameter. This is of considerable economic importance for with large fruit on thin stems much loss takes place by the stems breaking. The loss is especially heavy with plants of a poor strain, as it also is with plants growing in

poor sandy soil where it is, more or less, difficult to keep even the best type of plant up to a high degree of normality. With a desirable strain of plant grown on suitable soil weak stems is not a problem. Furthermore, the very luxuriant leaf-growth helps to support the fruit.

The pineapple is a multiple fruit, each individual fruit being represented by a so called eye. These eyes are developed from flowers, the number of which is determined in the embryo stage. They are thirteen on the line of circumference in all Red Spanish types grown in Porto Rico, regardless of size, but the number varies on the line from base to crown according to size. The size 12 or larger contains 8 and 9 eyes in alternate rows from base to crown or a total of 110; the sizes 16 and 18 contain 7 and 8 or a total of 97; the sizes 24 and 30 contain 6 and 7 or a total of 84; the size 36 and sometimes 42 contain 5 and 6 or a total of 71, and the size 48 contains 4 and 5 or a total of 58. This applies to fruit of the cone-shaped type, but as the shape varies the figures overlap somewhat and they do not apply closely to the short, stubby type.

The diameter of commercial sizes ranges from 3-11/16 inches in the size 48 to 6-1/4 inches in the size 12, but as the number of eyes on the diameter does not vary it is evident that the diameter of the fruit is due entirely to the expansion of the individual eyes. The same is not entirely the case in regard to length, but largely so for actually the difference between a size 16, with 97 eyes and a 24 with 84 eyes is greater than would be expected from the additional 13 eyes.

The size of the bloom is governed by the size of the stalk and the state of normality of the plant at the time of blooming. As mentioned in the former article, the stalk may be large and yet the fruit produced may be small. On the other hand a small stalk cannot produce a large flowerhead and fruit-stem, even though the plant is normal. This is illustrated in the following example: The winter months of 1926-27 were very rainy in the Bayamón section and as a consequence, in many fields, plants that were set the previous summer bloomed when 10 to 12 months old. In one field under observation the plants were unusually vigorous during the first period of growth, but due to the short growing period before blooming the stalks were small and the bloom indicated fruit sizes of 36 and 42.

In the case described above, as in many similar cases where plants bloom because of some shock such as root injury or abnormal nutrition due to an excess of water or a lack of it, the size of the fruit may not be impaired if the stalk is well developed and the shock is not so severe as to cause too great dormancy. But, of course, blooming caused by such a shock is, more or less, abnormal and the size is liable to be smaller than if one hundred per cent normalcy prevailed throughout the entire growing period.

The development of the fruit after blooming is affected by two main factors: The normality of the plant when blooming, and the growing conditions from that time until maturity. The factors governing normality have been described in former articles. A good example of a one hundred per cent normal plant in Porto Rico is one grown, under favorable weather conditions, in well drained, well aerated soil, that contains considerable humus and plant nutrients, the reaction of which is well below pH 6 and the colloidal matter of which is well flocculated. Such a plant will be in condition, at the time of blooming, to respond to any treatment that may be necessary for developing the fruit. Of course, if the conditions mentioned are maintained, nothing more will be required. It is conceivable, however, that there may be a shortage of moisture or plant nutrients or both, at the time of blooming and after. This the planter may supply without hesitation. But an abnormal plant, the leaves of which are, in a high degree senescent, it will not be profitable to fertilize or irrigate, although theoretically such treatment would be liable to increase the size of the fruit.

CONTROL OF BLOOMING. - As blooming is, to some extent, independent of season and age of plant the question is: what induces it? This question cannot yet be answered except in general terms. The hope was entertained, for a year or more, during this investigation, that the protein-carbohydrate ratio might be a measure of the difference between a fruiting and a non-fruiting plant. That was found to be the case in a broad, general sense, but a tabulation of the data collected shows that plants which are very different, one from another, cannot be compared. That is a very vigorous fruiting plant must be compared with a non-fruiting plant of the same type. Likewise a fruiting plant that is, for some cause, more or less senescent, must be compared with a non-fruiting plant in which senescence is brought about by a similar cause. This was done and it was found that such plants are frequently very much alike in protein and carbohydrate content. That may be due to the sluggishness of the pineapple plant. Perhaps the changes, which might be expected to take place suddenly, before the bloom is formed, does actually take place slowly, starting some considerable time before blooming. More work along this line may clear up a number of problems that are yet obscure.

The following examples will illustrate the nature of the problems and also furnish suggestions that will be helpful in solving them:

EXAMPLE 1. - In a field, planted with slips July, 1925, several hundred plants, in a well defined area, bloomed a few weeks after being set. An investigation showed that the phenomena could not be attributed to the slips. The soil which was very sandy, appeared to have had trash burned upon it, although not recently. The pH was above 6 but in no case above 7. The humus content was low and the colloidal matter was much deflocculated. In fact, the area in question was a typical unsuit-

able spot, like many others frequently encountered in pineapple fields. But the plants, in such spots, do not usually bloom at so young an age as these did.

Ammonium sulphate was applied and the plants promptly threw out suckers which soon caught up with normal plants in adjacent beds. An effort was made to induce blooming in other plants by reproducing the conditions described, but without result. Evidently some unknown factor was involved.

EXAMPLE 2. - In fertilizer experiments the plants in plots receiving phosphate invariably bloomed earlier than those receiving ammonium sulphate and potassium sulphate only. The difference in those plants has been described in former articles. Phosphate causes senescence and in the senescent plants the protein-carbohydrate ratio is high, which is an indication that such a condition is necessary for fruiting. But it is not a proof, for no such degree of senescence is produced in the no-phosphate plants, nor in any plant of a desirable strain grown in suitable soil. Yet it is probable that such plants might be induced to bloom if an application of phosphate were made at the proper time. Whether or not that would be advisable is a question. The effect on the plant, that is expected to produce another crop and on the slips as well, might offset the benefit of timely fruiting.

EXAMPLE 3. - In all fields and under all conditions in Porto Rico fruiting is scattered. Some plants may bloom ten months after planting, whereas others may not bloom until twenty months, or more after, although the majority will bloom when about fifteen months old. These differences are, to some extent, due to differences in the slips, but much more frequently they are caused by environmental factors. An abnormal root system and abnormal nutrition caused by insects, nematodes or unsuitable soil conditions are the usual causes of early blooming. But it does not follow that normal vigorous growth causes extreme late blooming. On the contrary, the extreme late blooming plants are usually retarded in development without being off-color or abnormal in outward appearance.

The root injury, as a cause of early blooming, may perhaps be taken advantage of as a means for controlling blooming. The work, along that line, is not yet finished. From the data at hand it is evident that a good grade of slips, planted on suitable soil and suitably fertilized, can be relied upon to produce plants, capable of bearing large fruit, in about twelve months. It remains to be proved how much root injury at that time will be necessary to induce blooming, how long after, such injury is produced, will the bloom form and to what extent will fertilizing, at the time of blooming, affect the size and quality of the fruit?